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Mindfulness and Emotional Outcomes: Identifying Subgroups of College Students Using Latent Profile Analysis

Matthew R. Pearson

Adrienne K. Lawless

David B. Brown

Adrian J. Bravo
Old Dominion University

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Matthew R. Pearson,
Center on Alcoholism, Substance Abuse, & Addictions, University of New Mexico

Adrienne K. Lawless,
Center on Alcoholism, Substance Abuse, & Addictions, University of New Mexico

David B. Brown, and
Center on Alcoholism, Substance Abuse, & Addictions, University of New Mexico

Adrian J. Bravo
Department of Psychology, Old Dominion University

Abstract

In non-meditating samples, distinct facets of mindfulness are found to be negatively correlated, preventing the meaningful creation of a total mindfulness score. The present study used person-centered analyses to distinguish subgroups of college students based on their mindfulness scores, which allows the examination of individuals who are high (or low) on all facets of mindfulness. Using the Lo-Mendell-Rubin Adjusted LRT test, we settled on a 4-class solution that included a high mindfulness group (high on all 5 facets, $N = 245$), low mindfulness group (moderately low on all 5 facets, $N = 563$), judgmentally observing group (high on observing, but low on non-judging and acting with awareness, $N = 63$), and non-judgmentally aware group (low on observing, but high on non-judging and acting with awareness, $N = 70$). Consistent across all emotional outcomes including depressive symptoms, anxiety symptoms (i.e., worry), affective instability, and distress intolerance, we found that the judgmentally observing group had the most maladaptive emotional outcomes followed by the low mindfulness group. Both the high mindfulness group and the non-judgmentally aware group had the most adaptive emotional outcomes. We discuss the implications of person-centered analyses to exploring mindfulness as it relates to important psychological health outcomes.

Keywords

Mindfulness; Depression; Anxiety; Lability; Distress Tolerance; Latent Profile Analysis; Person-Centered Analysis; College Students

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Mindfulness has been defined as the awareness that comes from paying attention to present moment experience in a purposeful and non-judgmental manner (Bishop et al., 2004; Kabat-Zinn, 1994). The difficulty with this conceptual definition is that it contains multiple components that may be a challenge to assess empirically. With the Five Facet Mindfulness Questionnaire (FFMQ), Baer et al. (2006) have attempted to measure five specific components of mindfulness in a multi-factorial questionnaire. Specifically, the FFMQ assesses acting with awareness (e.g., "It seems I am 'running on automatic' without much awareness of what I'm doing"), non-judging of inner experience, (e.g., "I criticize myself for having irrational or inappropriate emotions"), non-reactivity to inner experience (e.g., "I perceive my feeling and emotions without having to react to them"), describing (e.g., "I am good at finding the words to describe my feelings"), and observing (e.g., "When I am walking, I deliberately notice the sensations of my body moving").

Although researchers frequently use the specific factors from the FFMQ in the prediction of outcomes (Desrosiers, Klemanski, & Nolen-Hoeksema, 2013; Pearson, Brown, Bravo, & Witkiewitz, 2014) or as outcome variables following mindfulness-based interventions (Carmody & Baer, 2008), researchers frequently use a total score composite as an overall measure of mindfulness (Desrosiers, Vine, Klemanski, & Nolen-Hoeksema, 2013; Pepping, Davis, & O'Donovan, 2012). However, multiple studies in primarily non-meditating samples have found some negative correlations among mindfulness facets, especially between observing and non-judging of inner experience ($r = -.07$, Baer et al., 2006; $r = -.38$, Brown et al., 2014). These negative intercorrelations of FFMQ facets prevent the meaningful creation of a total composite score. For example, in a factor analysis model using the five FFMQ subscales as indicators, we find that the observing facet loads negatively on an overall latent construct of mindfulness (Author et al., 2014), which is consistent with Baer et al. (2006) who reported that loading the observing facet onto a latent mindfulness factor in a non-meditating sample fit poorly. Thus, in a factor analytic model, mindfulness becomes defined as individuals who are high in four of the five facets of mindfulness, but low in observing. Conceptually, observing is an important component of mindfulness and should not be considered the opposite of mindfulness. Interestingly, observing has been shown to be positively related to psychological symptoms among college students without prior meditation experience, whereas it has been shown to be negatively related to these outcomes among individuals with meditation experience (Baer et al., 2008). Further, observing has been found to be the mindfulness facet that is most strongly positively correlated with meditation experience (Baer et al.) and increases following mindfulness based interventions (Carmody & Baer, 2008). These results confirm that observing is an important facet of mindfulness that can be cultivated through mindfulness practices.

The findings reviewed above present a serious problem for variable-centered analyses (e.g., factor analysis, structural equation modeling, and multiple regression) that may be ameliorated by the use of person-centered analyses. Latent profile analysis (LPA), or latent class analysis, is a person-centered statistical technique that assumes that the pattern of means on observed variables can be accounted for by the existence of distinct latent classes, or subpopulations, of individuals. Thus, if we assume that there are distinct classes of

individuals in terms of their level of mindfulness, LPA is a technique that can be usefully applied to analyzing mindfulness data and has several strengths over more traditional variable-centered analyses. Despite the negative correlations between some mindfulness facets, LPA is able to distinguish between classes that are high on all facets of mindfulness, or low on all facets of mindfulness. According to some theoretical models (e.g., Shapiro et al., 2006), mindfulness is best understood as an integrated whole, that is, cultivating high mindfulness should be associated with being high on all of the components of mindfulness. Therefore, individuals high on all facets of mindfulness should be expected to experience the health benefits associated with mindfulness.

Launching a similar critique of variable-centered approaches, Lilja et al. (2013) used hierarchical cluster analysis to identify 13 clusters of individuals based on their mindfulness scores (cluster size ranged from 37 to 93 participants). Subsequently, they compared each cluster in terms of whether meditators were significantly overrepresented or underrepresented. They hypothesized that clusters overrepresented by meditators would be high on the observing facet of mindfulness, whereas clusters underrepresented by meditators would be low on observing. Supporting these hypotheses, meditators were overrepresented in four clusters, all of which had higher than average observing scores, and meditators were underrepresented in three clusters, all of which had lower than average observing scores. However, they did not compare the clusters on any outcomes related to psychological functioning.

The purpose of the present study was to distinguish subgroups of college students based on their mindfulness scores using latent profile analysis and examine their emotional health outcomes. We chose latent profile analysis over other approaches (e.g., hierarchical cluster analysis) as it is a theoretically superior technique that considers membership to be probabilistic and takes into account size of class when assigning probabilistic class membership. We had no *a priori* hypotheses regarding how many latent classes we would find, but expected that there would be a latent class of individuals who were relatively high on all five facets of mindfulness. Further, we expected that this class would be the most adaptive on four distinct emotional health outcomes that were selected given their high prevalence among college students including depressive symptoms, anxiety symptoms (i.e., worry), affective instability, and distress intolerance.

Method

Participants and Procedure

Participants were recruited from the Psychology Department participant pools at a large, U.S. southwestern university (N = 663) to "complete a survey using a computer regarding their behavior" and a large, U.S. southeastern university (N = 281) to "complete a survey regarding their personal beliefs and behaviors." Three subjects were excluded from analyses as they did not complete the mindfulness measure, leading to an analytic sample of 941 participants (64.3% women). Most participants (92.7%) were between the ages of 18 and 25 (M = 20.55, *Median* = 19.00, SD = 4.353). In terms of racial groups, participants could select multiple classifications or no classifications. Most participants self-reported as White/ Caucasian (61%), with 13.2% Black/African American, 6.2% Asian, 1.4% Native Hawaiian/

Pacific Islander, and 13.3% "Other." Over a third (38.5%) of the sample self-identified with a Hispanic/Latino ethnicity. The assessment battery took approximately one hour to complete and participants received course credit for their participation. The studies were approved by the institutional review boards at the respective institutions.

Measures

Mindfulness—Mindfulness was assessed using the 39-item Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006) measured on a 5-point response scale (1 = *Never or very rarely true*, 5 = *Very often or always true*). The five facets assessed by the FFMQ include acting with awareness (e.g., "I rush through activities without being really attentive to them", reverse-coded), non-judging of inner experience, (e.g., "I tend to evaluate whether my perceptions are right or wrong," reverse-coded), non-reactivity to inner experience (e.g., "I watch my feelings without getting lost in them"), describing (e.g., "My natural tendency is to put my experiences into words"), and observing (e.g., "I intentionally stay aware of my feelings"). In the scale development sample, each facet was shown to have high internal consistency (e.g., αs .75 or above; Baer et al.), and were modestly positively correlated with all other facets (.15 < rs < .34) except for observing and non-judging, which were shown to be negatively correlated (r = −.07). The bivariate correlations, descriptive statistics, and internal consistency measures in the present sample are shown in Table 1.

Depressive symptoms—Depressive symptoms were assessed using the 20-item Center for Epidemiological Studies Depression-Revised (CESD-R; Eaton, Muntaner, Smith, Tien, & Ybarra, 2004) measured on a 5-point response scale (1 = *Not at all or Less than 1 day, 2 = 1–2 Days, 3 = 3–4 Days, 4 = 5–7 Days, 5 = Nearly Every day for 2 weeks)*. Example items include, "I felt depressed" and "I lost interest in my usual activities." Although strongly correlated with the original CESD (rs = .88 – .93) and highly internally consistency (αs = .90 – .96; Eaton et al.), the CESD-R was modified to better reflect the symptoms of major depressive disorder in DSM-IV (American Psychiatric Association, 1994).

Anxiety symptoms—Anxiety symptoms (i.e., worry) were assessed using the 16-item Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990) measured on a 5-point response scale (1 = *not at all typical of me*, 5 = *very typical of me*). Example items include, "My worries overwhelm me" and "Once I start worrying, I cannot stop". In the development samples (Meyer et al.), the PSWQ was shown to have a high internal consistency (α = .93), to have high test-retest reliability across 8–10 weeks (r = .92), and to be correlated with other measures of anxiety; further, the scale has been shown to distinguish between individuals with and without an anxiety disorder (Brown, Antony, & Barlow, 1992).

Affective lability—Affective lability was assessed using the short form 18- item Affective Lability Scale (ALS, Oliver & Simons, 2004) measured on a 4-point response scale (1 = *Very Undescriptive, 4 = Very Descriptive)*. Example items include, "Many times I feel nervous and tense and then I suddenly feel very sad and down" and "I shift back and forth from feeling perfectly calm to feeling uptight and nervous." In the scale development samples (Oliver & Simons), the short form of the ALS has been shown to have a high

internal consistency (α = .90), to have high test-retest reliability across 30 days (r = .73), to be strongly correlated with the 54-item long form (r = .94), and to demonstrate convergent/divergent validity with emotional outcomes (e.g., depression, affect intensity, emotional control).

Distress intolerance—Distress intolerance was assessed using the 15-item Distress Tolerance Scale (DTS, Simons & Gaher, 2005) measured on a 5-point response scale (1 = *Strongly Agree,* 5 = *Strongly Disagree*). Example items include, "Feeling distressed or upset is unbearable to me" and "I can't handle feeling distressed or upset." In the development sample, the DTS was found to have a high internal consistency (α = .89) and to be correlated with other affect-related variables (e.g., negative affect, affective lability); further, it has been shown to be positively correlated with the similar construct of discomfort intolerance (Cougle, Bernstein, Zvolensky, Vujanovic, & Macatee, 2013).

Results

To determine the number of latent classes in our sample based on the pattern of means of the five subscales of the FFMQ, we used the Lo-Mendell-Rubin Adjusted Likelihood Ratio Test (Lo et al., 2001; Vuong, 1989), which compares whether a k class solution fits better than a k – 1 class solution. The Likelihood Ratio Test suggests that a 2-class solution fit better than a 1-class solution (p < .001), a 3-class solution fit better than a 2-class solution (p = .020), and a 4-class solution fit better than a 3-class solution (p = .025); however, a 5-class solution did not fit significantly better than a 4-class solution (p = .413). Table 2 reports commonly used fit statistics for 1 through 6 class solutions. Although the Akaike Information Criterion (AIC; Akaike, 1973, 1974; and see Sakamato, Ishiguro, & Kitagawa, 1986) and Bayesian Information Criterion (BIC, Schwarz, 1978) continue to improve (i.e., decrease) from 1 through 6 class solutions, Entropy was highest for the 5-class solution.

Given the results of the Likelihood Ratio Test, we settled on the 4-class solution. The entropy value of .748 indicates that it is estimated that about three-fourths of subjects were correctly classified in the appropriate latent class, which approaches a level of entropy that is considered high (i.e., 80, Clark & Muthén, 2009). Figure 1 depicts the pattern of means across the latent classes. Scores have been standardized so that positive values are above the mean and negative values are below the mean. Class 1 comprised 7.79% of the sample (N = 73.32), and we tentatively label this class the "judgmentally observing group" as they were the highest on observing (z = 1.001), but very low on non-judging of inner experience (z = −1.660) and acting with awareness (z = −1.545). Class 2 comprised 27.15% of the sample (N = 255.49), and we label this class the "high mindfulness group" as they were relatively high on every facet of mindfulness (.472 < zs < .911). Class 3 comprised 7.61% of the sample (N = 71.61), and we label this class the "non-judgmentally aware group" as they were high on non-judging of inner experience (z = 1.278) and acting with awareness (z = 1.082), but very low on the observing facet of mindfulness (z = −1.535). Finally, the largest group, Class 4, comprised 57.45% of the sample (N = 540.59), and we label this class the "low mindfulness group" as they were moderately low on all facets of mindfulness (−.330 < zs < −.110).

Based on our 4-class solution, we tested the equality of means across latent classes on various emotional outcomes using pseudo-class-based multiple imputations (Asparouhov, 2007). Rather than assigning individuals to the latent class where their membership has the highest probability and conducting traditional techniques like analysis of variance (ANOVA), this method accounts for the probabilistic nature of class membership, and both global and pairwise comparisons can be conducted using Wald tests. These results were remarkably consistent across emotional outcome variables and are depicted in Table 3. Across each emotional outcome, we found that the "high mindfulness" (Class 2) and "non-judgmentally aware" (Class 3) groups had the most adaptive emotional outcomes (i.e., lower depressive symptoms, anxiety symptoms, affective lability, and distress intolerance), and did not significantly differ from each other on any outcome. In contrast, the "judgmentally observing" group (Class 1) had the poorest emotional outcomes (i.e., highest depressive symptoms, anxiety symptoms, affective lability, and distress intolerance), which were significantly worse than all other groups. Finally, the "low mindfulness group" was always significantly better than the "judgmentally observing" group (Class 4) on these outcomes, but significantly worse than the "non-judgmentally aware" and "high mindfulness groups."

Discussion

One of the limitations of variable-centered analyses is that they assume that all participants have been sampled from a single population (i.e., population homogeneity assumption, Collins & Lanza, 2010). In terms of examining the construct of *mindfulness*, traditional factor analyses in college student samples places the observing facet as negatively correlated with a latent factor of mindfulness despite the observing facet as being a face and content valid indicator of mindfulness (Baer et al., 2008; Brown et al., 2014). To circumvent these limitations of variable-centered analyses, we conducted latent profile analysis (LPA), a person-centered approach that attempts to find homogenous subpopulations within a heterogeneous sample. LPA essentially attempts to find distinct classes of individuals who are similar to one another and distinct from individuals from other classes. We found four distinct classes of individuals defined by the pattern of the scores on the five facets of mindfulness (Baer et al., 2006). Specifically, not only did we find high and low mindfulness groups, but also found groups defined by high observing paired with low non-judging/acting with awareness (i.e., judgmentally observing) and low observing paired with high non-judging/acting with awareness (i.e., non-judgmentally aware). These latter two groups appear to drive the negative correlation between the observing facet with these other mindfulness facets (i.e., non-judging, acting with awareness).

Consistent with variable-centered analyses that show negative correlations between mindfulness and emotional disturbances (Barnhofer, Duggan, & Griffith, 2011; Carlson, Ursuliak, Goodey, & Speca, 2001; Goldin & Gross, 2010; Keng, Smoski, & Robins, 2011; Teasdale, Segal, Williams, Ridgeway, Soulsby, & Lau, 2000), we found that the low mindfulness group had more negative emotional symptoms compared to the high mindfulness group. However, we also found that the non-judgmentally aware group, which was low on the observing, describing, and non-reactivity to inner experience facets, had adaptive emotional outcomes as well. Further, the judgmentally observing group closely resembled the low mindfulness group in terms of emotional outcomes despite being the

highest on the observing facet of all groups. The sharp contrast in emotional functioning of the non-judgmentally aware and judgmentally observing groups suggests the relative importance of non-judging of inner experience and acting with awareness to achieve adaptive emotional functioning, which supports previous definitions of mindfulness (Bishop et al., 2004; Kabat-Zinn, 1994).

This preliminary investigation begins to show the promise of LPA in separating groups of individuals based on their profile of mindfulness scores. The longitudinal extension of LPA, latent transition analysis, holds incredible promise for examining the efficacy of mindfulness-based interventions as it allows the examination of transitions in latent class membership over time. For example, the goal of a mindfulness-based intervention can be thought of as transitioning individuals from one of the less adaptive classes into one of the more adaptive classes. It is important to note that the largest class in this sample of college students was the low mindfulness group, comprising 57.44% of the sample, suggesting that mindfulness-based interventions could have a meaningful impact in this population.

Limitations

It is important to consider the limitations of the present study when interpreting the results. First, we do not wish to suggest that there are exactly four classes of individuals who differ in their mindfulness scores in the populations. Much additional work with large samples from distinct populations is needed to determine the number of classes in the broader population. Second, as differences in factor structure has been found depending on whether one had meditation experience (Baer et al., 2008), it would helpful to examine whether the same number of latent classes are found in meditating and non-meditating samples. Third, although improved emotional functioning has been one target of mindfulness based interventions (Segal, Williams, & Teasdale, 2012), other targets including chronic pain have also been targeted (Kabat-Zinn, 1982), but were not examined in the present study. Thus, it is important to examine how these latent classes differ on a broader range of physical and mental health variables. Finally, the cross-sectional study design prevents our ability to make causal inferences. Although we have assumed that mindfulness profiles are important in explaining differences across subgroups' emotional functioning, there are several 'third variable' explanations for our findings for which we cannot account. Examining the effects of mindfulness-based interventions on transitions in class membership longitudinally, and the effects of class transitions on subsequent outcomes would provide the strongest test of the utility of a person-centered approach.

Conclusion

Despite the limitations of the present study, we were able to distinguish between four subgroups of individuals based on their mindfulness profiles, and found two 'adaptive' and two 'maladaptive' groups. Individuals high on all facets of mindfulness showed adaptive emotional functioning along with a group high on only two facets of mindfulness (non-judging of inner experience, acting with awareness). Individuals low on all facets of mindfulness showed less adaptive emotional functioning along with a group high on the observing facet of mindfulness, but particularly low on non-judging of inner experience and acting with awareness.

Acknowledgments

References

Akaike, H. Information theory and an extension of the maximum likelihood principle. In: Petrov, BN.; Casaki, F., editors. Second International Symposium on Information Theory. Budapest: Academiai Kiado; 1973. p. 267-281.

Akaike H. A new look at the statistical model identification. Automatic Control, IEEE Transactions on. 1974; 19:716–723.10.1109/TAC.1974.1100705

American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4. Washington, DC: Author; 1994.

Asparouhov, T.; Muthén, B. Proceedings of the 2007 Joint Statistical Meetings, Section on Statistics in Epidemiology. Alexandria, VA: American Statistical Association; 2007. Computationally efficient estimation of multilevel high-dimensional latent variable models; p. 2531-2535.

Baer RA, Smith GT, Hopkins J, Krietemeyer J, Toney L. Using self-report assessment methods to explore facets of mindfulness. Assessment. 2006; 13:27–45.10.1177/1073191105283504 [PubMed: 16443717]

Baer RA, Smith GT, Lykins E, Button D, Krietemeyer J, Sauer S, Williams JMG. Construct validity of the five facet mindfulness questionnaire in meditating and nonmeditating samples. Assessment. 2008; 15:329–342.10.1177/1073191107313003 [PubMed: 18310597]

Barnhofer T, Duggan DS, Griffith JW. Dispositional mindfulness moderates the relation between neuroticism and depressive symptoms. Personality and Individual Differences. 2011; 51:958–962. [PubMed: 22180693]

Bishop SR, Lau M, Shapiro S, Carlson L, Anderson ND, Carmody J, Segal ZV, Abbey S, Speca M, Velting D, Devins G. Mindfulness: a proposed operational definition. Clinical Psychology: Science and Practice. 2004; 11:230–241.10.1093/clipsy/bph007

Brown DB, Bravo AJ, Roos CR, Pearson MR. Five facets of mindfulness and psychological symptoms: Evaluating a psychological model of the mechanism of mindfulness. Mindfulness. in press.

Carlson LE, Ursuliak Z, Goodey E, Angen M, Speca M. The effects of a mindfulness meditation-based stress reduction program on mood and symptoms of stress in cancer outpatients: 6-month follow-up. Supportive Care in Cancer. 2001; 9:112–123. [PubMed: 11305069]

Carmody J, Baer RA. Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program. Journal of Behavioral Medicine. 2008; 31:23–33. [PubMed: 17899351]

Clark SL, Muthén B. Relating latent class analysis results to variables not included in the analysis. 2009 Submitted for publication.

Collins, LM.; Lanza, ST. Latent class and latent transition analysis with applications in the social, behavioural, and health sciences. Hoboken, NJ: John Wiley & Sons, Inc; 2010.

Desrosiers A, Klemanski DH, Nolen-Hoeksema S. Mapping mindfulness facets onto dimensions of anxiety and depression. Behavior Therapy. 2013; 44:373–384. [PubMed: 23768665]

Desrosiers A, Vine V, Klemanski DH, Nolen-Hoeksema S. Mindfulness and emotion regulation in depression and anxiety: common and distinct mechanisms of action. Depression and Anxiety. 2013; 30:654–661. [PubMed: 23592556]

Eaton, WW.; Muntaner, C.; Smith, C.; Tien, A.; Ybarra, M. Center for Epidemiologic Studies Depression Scale: Review and revision (CESD and CESD-R). The Use of Psychological Testing for Treatment Planning and Outcomes Assessment. 3. Maruish, ME., editor. Mahwah, NJ: Lawrence Erlbaum; 2004. p. 363-377.

Goldin PR, Gross JJ. Effects of mindfulness-based stress reduction (MBSR) on emotion regulation in social anxiety disorder. Emotion. 2010; 10:83–91. [PubMed: 20141305]

Kabat-Zinn J. An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. General Hospital Psychiatry. 1982; 4:33–47. [PubMed: 7042457]

Kabat-Zinn, J. Wherever you go, there you are: Mindfulness meditation in everyday life. New York, NY: Hyperion Books; 1994.

Keng SL, Smoski MJ, Robins CJ. Effects of mindfulness on psychological health: A review of empirical studies. Clinical Psychology Review. 2011; 31:1041–1056. [PubMed: 21802619]

Lo Y, Mendell N, Rubin D. Testing the number of components in a normal mixture. Biometrika. 2001; 88:767–778.10.1093/biomet/88.3.767

Meyer TJ, Miller ML, Metzger RL, Borkovec TD. Development and validation of the Penn state worry questionnaire. Behaviour research and therapy. 1990; 28(6):487–495. [PubMed: 2076086]

Meyer TJ, Miller ML, Metzger RL, Borkovec TD. Development and validation of the Penn state worry questionnaire. Behavior Research and Therapy. 1990; 28:487–495.10.1016/0005-7967(90)90135-6

Oliver MN, Simons JS. The affective lability scales: Development of a short-form measure. Personality and Individual Differences. 2004; 37:1279–1288.

Pearson MR, Brown DB, Bravo AJ, Witkiewitz K. Staying in the moment and finding purpose: The associations of trait mindfulness, decentering, and purpose in life with depressive symptoms, anxiety symptoms, and alcohol-related problems. Mindfulness. 2014:1–9.10.1007/s12671-014-0300-8

Pepping CA, Davis PJ, O'Donovan A. Individual differences in attachment and dispositional mindfulness: The mediating role of emotion regulation. Personality and Individual Differences. 2013; 54:453–456.

Sakamoto, Y.; Ishiguro, M.; Kitagawa, G. Akaike information criterion statistics. Dordrecht, The Netherlands: D. Reidel; 1986.

Segal, ZV.; Williams, JMG.; Teasdale, JD. Mindfulness-based cognitive therapy for depression. Guilford Press; 2012.

Schwarz G. Estimating the dimension of a model. The Annals of Statistics. 1978; 6:461–464.10.1214/aos/1176344136

Shapiro SL, Carlson LE, Astin JA, Freedman B. Mechanisms of mindfulness. Journal of Clinical Psychology. 2006; 62:373–386.10.1002/jclp.20237 [PubMed: 16385481]

Simons JS, Gaher RM. The distress tolerance scale: Development and validation of a self-report measure. Motivation and Emotion. 2005; 29:83–102.10.1007/s11031-005-7955-3

Vuong Q. Likelihood ratio tests for model selection and non-nested hypotheses. Econometrica. 1989; 57:307–333.10.2307/1912557

Teasdale JD, Segal ZV, Williams JMG, Ridgeway VA, Soulsby JM, Lau MA. Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy. Journal of Consulting and Clinical Psychology. 2000; 68:615–623. [PubMed: 10965637]

- We used latent profile analysis to group college students based on mindfulness scores

- A 4-class solution was selected, leading to four subgroups of college students

- High mindfulness and non-judgmentally aware groups had adaptive outcomes

- Low mindfulness and judgmentally observing groups had maladaptive outcomes

- We discuss the implications of person-centered analyses for studying mindfulness
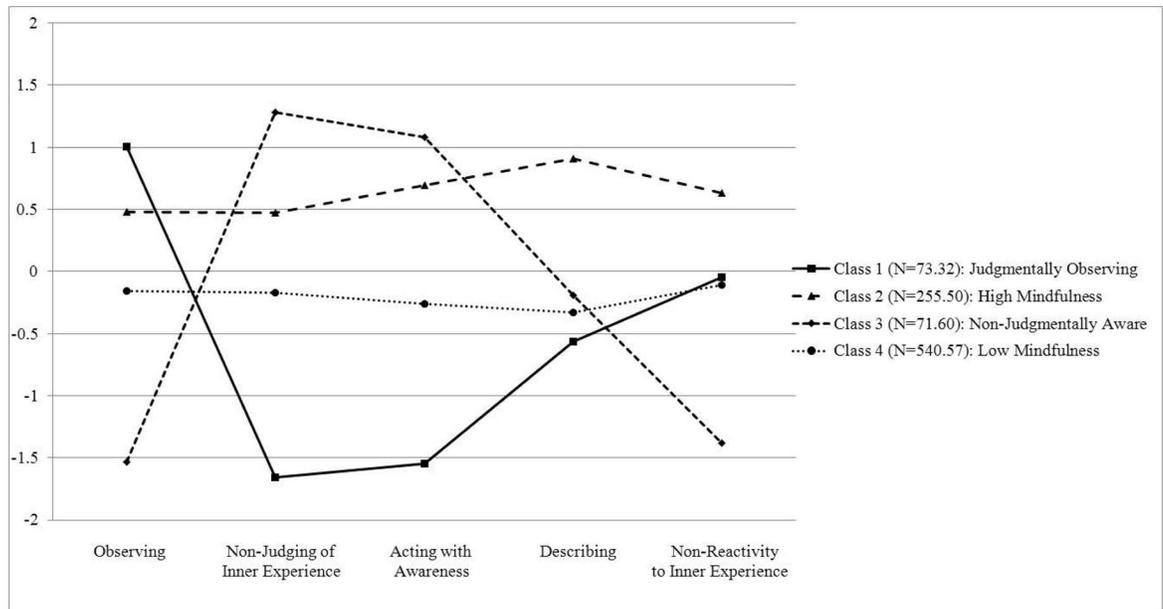
Figure 1.
Depiction of the four latent classes defined by pattern of standardized means on five facets
of mindfulness

Table 1

Bivariate correlations and descriptive statistics among all study variables

	1	2	3	4	5	6	7	8	9	M	SD
1. Observing	.80									3.28	0.69
2. Describing	**.22**	.86								3.32	0.73
3. Acting with Awareness	**−.15**	**.32**	.87							3.25	0.75
4. Non-Judging	**−.31**	**.19**	**.49**	.89						3.12	0.82
5. Non-Reactivity	**.40**	**.31**	−.01	−.03	.77					3.04	0.63
6. Depressive Symptoms	**.10**	**−.25**	**−.46**	**−.49**	**−.19**	.94				1.89	0.77
7. Anxiety Symptoms (Worry)	.04	**−.22**	**−.33**	**−.42**	**−.25**	**.43**	.93			3.17	0.89
8. Affective Lability	**.14**	**−.26**	**−.50**	**−.51**	**−.10**	**.61**	**.45**	.95		1.99	0.68
9. Distress Intolerance	**.12**	**−.23**	**−.43**	**−.52**	**−.15**	**.53**	**.52**	**.60**	.93	2.58	0.85

Note. Significant correlations (*p* < .05) are bolded for emphasis. Cronbach's alphas are underlined and shown on the diagonal.

Table 2

Fit statistics for 1 through 6 class solutions for Latent Profile Analysis (LPA)

Fit Statistics	Number of Classes					
	1	2	3	4	5	6
AIC	10281.15	10011.07	9755.66	9586.20	9519.25	9460.23
BIC	10329.62	10088.62	9862.29	9721.91	9684.05	9654.11
Adjusted BIC	10297.86	10037.80	9792.42	9632.98	9576.07	9527.07
Entropy	-----	0.547	0.685	0.748	0.785	0.756
Smallest *n*	941	434	104	63	35	22

Note. AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion.

Table 3

Mean comparisons between latent classes on mindfulness facets and emotional outcomes

	Class 1: Judgmentally Observing	Class 2: High Mindfulness	Class 3: Non-Judgmentally Aware	Class 4: Low Mindfulness
	Raw Scores			
Observing	3.970_a	3.607_b	2.214_c	3.164_d
Describing	2.910_a	3.986_b	3.182_c	3.082_{ac}
Acting with Awareness	2.086_a	3.737_b	4.055_c	3.047_d
Non-Judging	1.757_a	3.502_b	4.156_c	2.975_d
Non-Reactivity	3.007_a	3.430_b	2.170_c	2.966_a
Depressive Symptoms	2.796_a	1.557_b	1.468_b	1.973_c
Anxiety Symptoms (Worry)	3.859_a	2.815_b	2.922_b	3.282_c
Affective Lability	2.787_a	1.642_b	1.590_b	2.106_c
Distress Intolerance	3.459_a	2.189_b	2.028_b	2.715_c
	Standardized Scores (z-scores)			
Observing	1.001_a	0.481_b	-1.535_c	-0.159_d
Describing	-0.564_a	0.911_b	-0.190_c	-0.330_{ac}
Acting with Awareness	-1.545_a	0.694_b	1.082_c	-0.264_d
Non-Judging	-1.660_a	0.472_b	1.278_c	-0.170_d
Non-Reactivity	-0.046_a	0.631_b	-1.382_c	-0.110_a
Depressive Symptoms	1.189_a	-0.422_b	-0.535_b	0.110_c
Anxiety Symptoms (Worry)	0.771_a	-0.398_b	-0.281_b	0.122_c
Affective Lability	1.172_a	-0.510_b	-0.590_b	0.162_c
Distress Intolerance	1.039_a	-0.452_b	-0.649_b	0.158_c

Note. Means sharing a subscript in a row indicate means that are not significantly different from each other. FFMQ = Five Facet Mindfulness Questionnaire.